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October 3, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco,

Docket No. 52-021
MHI Ref: UAP-HF-08215

Subject: MHI's Responses to US-APWR DCD RAI No.63

Reference: 1) "Request for Additional Information No.63 Revision 0, SRP Section: 09.04.01 – Control Room Area Ventilation System, Application Section: Tier 2 FSAR 9.4.1," dated September 4, 2008.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.63 Revision 0".

Enclosed are the responses to 32 RAIs contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Responses to Request for Additional Information No.63 Revision 0

CC: J. A. Ciocco
C. K. Paulson

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NRO

Enclosure 1

UAP-HF-08215
Docket Number 52-021

Responses to Request for Additional Information No.63 Revision 0

October 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-1

US APWR DCD section 9.4.1 states that the MCR HVAC system complies with GDC 2. The review of DCD Section 9.4.1 could not find GDC 2 addressed completely or by reference. Provide additional information on where GDC 2 is addressed completely or by reference in DCD section 9.4.1.

ANSWER:

RG 1.206 prescribes a requirement for GDC 2. DCD Subsection 9.4.1, first bullet references the compliance as "The MCR HVAC system complies with 10 CFR 50, Appendix A, GDC 2." GDC 2 is also referenced in the fourth bullet of Section 9.4.1.1.1 as "Designed to withstand the effects of tornadoes and tornadoes missiles" and the fifth bullet as "Designed to withstand the effects of seismic events". Unlike GDC 19 there is no specific reference to requirements for GDC 2 in Subsection 9.4.1 of RG 1.206. MHI believes that the reference to GDC 2, which applies to all Subsection of 9.4.1, is adequate without additional DCD modification.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-2

US APWR DCD section 9.4.1 does not include Regulatory Guide (RG) 1.29 in the list of RGs that the MCR HVAC system must comply with. Under GDC 2, Regulatory Guide 1.29 provides the guidance for meeting control room protection requirements. Provide additional information on why RG 1.29 is not referenced on the list and addressed in sufficient detail for its application to the MCR HVAC system.

ANSWER:

RG 1.206 prescribes a requirement that the SSCs shall be designed to insure the reliability such as seismic design. RG 1.29 states that all safety-related SSCs be designated as "Seismic category 1 to remain functional if the SSE occurs". DCD Subsection 9.4.1, first bullet references the compliance as "The MCR HVAC system complies with 10 CFR 50, Appendix A, GDC 2." GDC 2 is also referenced in the fifth bullet as "Designed to withstand the effects of seismic events". The second sentence of the fifth bullet also references RG 1.29 as "The MCR HVAC system equipment and the associated ductwork are designed to seismic category I requirements". Unlike GDC 19 there is no specific reference to requirements for GDC 2 or RG 1.29 in Section C I 9.4.1 of RG 1.206. However, if GDC 2 is mentioned and satisfied then RG 1.29 is automatically satisfied with the fifth bullet of RG 1.29. MHI believes that the reference to GDC 2 and RG 1.29, which applies to all Section of 9.4.1, is adequate without additional DCD modification.

Impact on DCD

DCD Subsection 9.4.1, second bullet will be revised to add the RG 1.29 as follows:

9.4.1 Main Control Room Heating, Ventilation and Air Conditioning System

The MCR HVAC System is designed to provide and control the proper environment in the MCR and other areas within the control room envelope (CRE) as defined in Chapter 6, Section 6.4. The MCR HVAC system complies with:

• 10 CFR 50, Appendix A, GDC 2, 3, 4, 19
• 10 CFR 50.63
• RGs, **1.29,** 1.52, 1.78, 1.155, 1.196, 1.197

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
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APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-3

US APWR DCD section 9.4.1 does include RGs 1.78, 1.155, and 1.196 in the list of RGs that the MCR HVAC system complies with, but they were not clearly identified or addressed in section 9.4.1. Provide information and clarification on why RGs 1.78, 1.155, and 1.196 were not identified beyond the RG list or addressed completely by reference in section 9.4.1.

ANSWER:

RG 1.206 prescribes a requirement that the control room area ventilation system shall be designed to ensure performance and reliability for all modes of operation such as SBO (RG 1.155) and toxic gas (RG 1.78).

RG 1.78 provides guidance and requirements to detect and prevent toxic gas release in the control room habitability during a postulated hazardous chemical release. RG 1.78 is referenced in the last paragraph of DCD Subsection 9.4.1.1.1 as *"Proper MCR personnel protection against toxic gases is described in Chapter 6, Section 6.4."* Specific evaluation for toxic gas protection is addressed and RG 1.78 is discussed in detail in Subsection 6.4.4.2. Accordingly MHI believes that compliance to RG 1.78 is provided direct/by reference to Section 6.4. Hence no additional DCD modification is necessary.

RG 1.155 explains SBO event and its mitigation. RG 1.155 is referenced in the last paragraph of DCD Section 9.4.1.1.2 as *"The MCR HVAC System stop for one hour after SBO occurs until alternate AC gas turbine generator restores power. However, all Class 1E cabinets are rated to keep their integrity during loss of a HVAC system (Chapter 8, Section 8.4)."* This RG 1.155 is discussed in detail in Section 8.4. Accordingly MHI believes that compliance to RG 1.155 is provided direct/by reference to Section 8.4. Hence no additional DCD modification is necessary.

RG 1.196 is guideline for Control Room Habitability. RG 1.206 states that detailed discussion of MCR HVAC system should appear in Section 6.4 (Control Room Habitability). Discussion of the compliance with RG 1.196 in Section 6.4 is addressed in the response to RAI No.49 question 06.04-2. Refer to RAI No.49 question 06.04-2 for a response. Compliance to RG 1.196 in Subsection 9.4.1 is discussed in the "first" and "second" bullet of Subsection 9.4.1.1.1 by reference to Section 6.4. These bullets will be revised to add the description that refers to Section 6.4 in DCD revision 2.

Impact on DCD

DCD Subsection 9.4.1.1.1 will be revised to refer to Section 6.4 as follows:

9.4.1.1.1 Safety Design Bases

The MCR HVAC System is designed to:

- Exclude entry of airborne radioactivity into the CRE and remove radioactive material from the CRE environment such that radiation dose to MCR personnel is within the GDC 19~~ (10 CFR 50, Appendix A)~~**(Chapter 6, Section 6.4)**.
- Support and maintain CRE habitability and permit personnel occupancy and proper functioning of instrumentation during normal and design basis accidents, assuming a single active failure **(Chapter 6, Section 6.4)**.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-4

US APWR DCD section 9.4.1 states that the MCR HVAC system complies with GDC 3. The review of DCD section 9.4.1 could not find GDC 3 addressed completely or by reference. Per RG 1.196, as referenced in DCD section 9.4.1, provide additional information on where GDC 3 is addressed completely or by reference.

ANSWER:

DCD Subsection 9.4.1, first bullet references compliance as "The MCR HVAC system complies with 10 CFR 50, Appendix A, GDC 3." DCD Subsection 9.4.1 also refers to DCD Section 6.4 for more information on the MCR. GDC 3 is concerned with fire protection and DCD Section 6.4 refers to Section 9.5.1 the fire protection program for the entire plant, which includes all fire protection aspects associated with the MCR. Accordingly, MHI believes that the reference to GDC 3, which applies to DCD Section 9.4.1, is adequate without additional DCD modification.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-5

US APWR DCD section 9.4.1 states that the MCR HVAC system complies with GDC 4. The review of DCD section 9.4.1 could not find GDC 4 addressed completely or by reference. Provide additional information on where GDC 4 is addressed completely or by reference in DCD section 9.4.1. addressed completely or by reference.

ANSWER:

DCD Subsection 9.4.1, first bullet, references compliance as "The MCR HVAC system complies with 10 CFR 50, Appendix A, GDC 4." Compliance to GDC 4 is also described in the third bullet of Subsection 9.4.1.1.1 "as designed to withstand the effects of adverse environmental conditions". Unlike GDC 19, there is no specific reference for GDC 4 in Subsection 9.4.1 of RG 1.206. MHI believes that the reference to GDC 4, which applies to DCD Subsection 9.4.1, is adequate without additional DCD modification.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-6

US APWR DCD section 9.4.1 does not state compliance with GDC 60 in accordance with SRP acceptance criteria item 5. Provide information on why compliance with GDC 60 was not addressed completely or by reference for the MCR HVAC system in accordance with SRP 9.4.1 position II.5 acceptance criteria.

ANSWER:

RG 1.206 does not prescribe a specific requirement that the MCR HVAC system control the release of gaseous radioactive material to the environment. In the case of US-APWR, there are no radioactive materials stored in the CRE that can cause detrimental effect on personnel in the MCR. Therefore, there are no radioactive sources of material that can be released from the CRE. There is no gaseous radioactive material release to the environment through the MCR HVAC system. Hence, the MCR HVAC system does not need to satisfy GDC 60 requirement. The MCR HVAC system protects personnel by detecting and preventing the entry of smoke, toxic gas and radioactive material into the CRE by automatically aligning to the emergency mode of operation, which are isolation and pressurization respectively (DCD Section 6.4). This is in compliance with RG 1.206.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-7

US APWR DCD section 9.4.1.2.2.2 indicates this system has a smoke purge mode of operation. But this smoke mode is not shown in Table 9.4-1, sheet 1, as an abnormal condition like LOOP or SBO. SRP 9.4.1 section III.1 requires a review for normal and emergency operations, and the ambient temperature limits for the areas serviced. Clarify if Table 9.4-1, sheet 1, should include an additional smoke purge mode under abnormal conditions for the main control room area.

ANSWER:

The smoke purge mode of operation is not considered an abnormal condition. The smoke purge mode of operation is normally used after a fire has been extinguished. Typically, when smoke is detected, the ventilation system is automatically shutdown to minimize the spread of the smoke. After a fire in an area has been extinguished, the ventilation system is manually placed into the smoke purge mode of operation for quick removal of smoke from the area. The smoke purge mode of operation serves no safety-related function.

According to the SRP, the reviewer determines whether the ventilation system or portions of the system have been designed or need to be designed as safety-related systems and reviews them with respect to functional performance requirements during adverse environmental conditions, normal operation, anticipated operational occurrences and after a postulated accident, including the LOOP. The smoke purge portion of the MCR HVAC system outside the CRE and downstream of the safety-related isolation damper at the wall of the CRE does not serve any safety-related function and has no safety design bases.

Therefore, DCD Table 9.4-1 does not have to include smoke purge mode of operation under abnormal conditions.

Refer to response to the identical question, RAI No.49 Question No.06.04-11.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-8

SRP 9.4.1 sections III.1, III.3 and III.4 make reference to use of a failure modes and effects analysis, as appropriate, to confirm that the essential safety-related portions of the system are capable of functioning in spite of the failure of any active component, in the event of an earthquake, during loss of offsite power, or a concurrent single active failure. DCD section 9.4.1 does not contain any references to or COL items for a failure modes and effects analysis for the MCR HVAC system. The staff requests the DC applicant provide detailed information about the failure modes and effects analysis for the MCR HVAC system.

ANSWER:

The failure modes and effects analysis for MCR HVAC system will be added in DCD revision 2.

Impact on DCD

The failure modes and effects analysis for MCR HVAC system will be added in DCD revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-9

Provide additional details for the following DCD section 9.4.1, Table 9.4-1, sheet 1 values for the control room area ventilation system calculation procedures and methods, including assumptions and margins. Identify any deviations from the recommended calculational procedures in SRP section 9.4.1, Revision 3, March 2007:

· Main control room area calculations supporting the normal and abnormal condition min max temperatures

· Main control room area calculations supporting the normal and abnormal condition min max relative humidity %

ANSWER:

DCD Subsection 9.4.1, Table 9.4-1 shows the design temperature and relative humidity of each room, therefore these values are not decided from calculation. This design value of MCR is decided by the function as occupied area with light work. This value is based on the Utility Requirements Document (URD).

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-10

US APWR DCD section 9.4.1.4 invokes the use of Air Movement and Control Association standards, American Society of Heating, Refrigerating and Air Conditioning Engineers standards, Air Conditioning and Refrigeration Institute standards and Sheet Metal and Air Conditioning Contractors National Association standards for test purposes, but does not list the specific standards Section 9.4.8 "References" does not list these standards. Provide the specific standards for this testing and include them in the Reference section 9.4.8.

ANSWER:

Subsection 9.4.1.4 states that air-handling equipment is factory tested in accordance with Air Movement and Control Association (AMCA) standards. Currently, the AMCA standards for air handling equipment are as follows:

AMCA 210-2007 "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating"
AMCA 230-1999 "Laboratory Methods of Testing Air Circulating Fans for Rating and Certification"
AMCA 802-2002 "Industrial Process / Power Generation Fans: Establishing Performance Using Laboratory Models"

Air filters are tested in accordance with American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) standards. Currently, the ASHRAE standards for testing air filters are as follows:

ANSI/ASHRAE 52.1-1992 "Gravimetric and Dust Spot procedures for Testing Cleaning Devices Used in General Ventilation for Removing Particulate Matter"
ANSI/ASHRAE 52.2-2007 "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size".

Cooling Coils are tested in accordance with Air Conditioning and Refrigeration Institute (ARI) standards. Currently, the ARI standards for testing cooling coils are as follows:

ARI 410-2001 "Forced-Circulation Air-Cooling and Air-Heating Coils"
ARI 440-2005 "Performance Rating of Room Fan-coils"

Air distribution ductwork is leak-tested in accordance with the Sheet Metal and Air-conditioning Contractor's National Association. Currently, the SMACNA standards for the ductwork are as follows:

SMACNA 1143-1985 "HVAC Air Duct Leakage Test Manual – First Edition; Technical Research Update – 92"
SMACNA 1780 – 2002 "HVAC Systems Testing, Adjusting and Balancing – Third Edition"

Impact on DCD

The above information will be added in Subsection 9.4.8 of DCD revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-11

US APWR DCD section 9.4.1.1.2 discusses Station Blackout (SBO) for the electrical equipment areas in the MCR HVAC system. This condition is not listed in Table 9.4-1, sheet 3. SRP 9.4.1 section III.1 requires a review for normal and emergency operations, and the ambient temperature limits for the areas serviced. Provide information to clarify whether or not the SBO should also be listed in Table 9.4-1.

ANSWER:

Table 9.4-1 of DCD Subsection 9.4.1 shows the design condition of each room which the HVAC system should maintain, when the HVAC system is operating. Therefore, the design condition of each room that is served by the HVAC system after AAC GTG has restored power is shown in Table 9.4-1. However, until AAC GTG restores power within one hour after SBO occurs, the HVAC system can not operate. So the integrity of equipment that is required to operate within one hour after SBO occurs is addressed in DCD Section 8.4.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

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QUESTION NO. : 09.04.01-12

US APWR DCD section 9.4.1.1.2 reads that the MCR HVAC system can stop for one hour after SBO occurs until the alternate AC gas turbine generator restores power to the system. Provide additional details including calculations that establish the one hour delay basis with associated assumptions and margins and identify any deviations from the recommended calculational procedures in SRP Section 9.4.1, Revision 3, March 2007. Also provide information that verifies that the Table 9.4-1 MCR area normal and abnormal temperatures and humidity will be maintained within the established ranges for one hour after a SBO.

ANSWER:

Station Blackout (SBO) is described in DCD Section 8.4. The term "Station Blackout" as defined in 10 CFR 50.2 (Reference 8.2-13) means the complete loss of ac electric power to the essential and non essential switchgear buses in a nuclear power plant (i.e., the loss of offsite electric power system concurrent with a turbine trip and the unavailability of the onsite emergency ac power system). An SBO does not include the loss of available ac power to buses fed by the station batteries through inverters or by AAC sources, nor does it assume a concurrent single failure or PA.

According to Regulatory Guide RG 1.155, "Station Blackout" and its application to US-APWR is summarized in DCD Subsection 8.2.2.1 as follows:
"This regulatory guide provides guidance for complying with 10 CFR 50.63 (Reference 8.2-5). The plant has two AAC power sources, of which only one is required to be operational to cope with an SBO event. Power supply to all electrical loads that are required to be operational is restored within 60 minutes from the onset of an SBO event. Under normal plant operating conditions, both safety and non safety dc power systems derive power from the battery chargers that are fed from the safety and non safety 480V MCCs. Safety and non safety batteries will provide power to the dc power system during the first 60 minutes of an SBO event. Within 60 minutes of an SBO event, power from AAC sources would be available to the required battery chargers and the dc systems will be powered from the associated battery chargers. Hence, for an SBO condition, the batteries are required to be sized to provide their duty cycle current for a period of 60 minutes. The Class 1E batteries for the US-APWR are sized for the worst case duty cycle requirements for a period of two hours, considering loss of associated battery charger and plant conditions that include normal plant operation, LOOP, LOOP concurrent with LOCA and SBO."

The design condition of each room in Table 9.4-1 is the design condition for a normally operating

MCR HVAC system. For one hour after a SBO occurs, the MCR HVAC system is not operating. The MCR temperature will rise within the one hour before the AAC power source is available, but it is not expected to rise significantly. The integrity of MCR cabinet is addressed in DCD Section 8.4.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

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QUESTION NO. : 09.04.01-13

US APWR DCD section 9.4.1.2 reads that the MCR HVAC system has two redundant 100% filtration units, four 50% capacity air handling units, two redundant toilet/kitchen exhaust fan units, and one 100% smoke purge fan unit. Figure 9.4.1-1 shows redundant trains for the toilet/kitchen exhaust fan units. The smoke purge fan does not have a redundant fan unit shown. Provide additional information about the potential effects on operations with only a single smoke purge fan unit without redundant or backup capability for the purging of smoke from the MCR during a fire. Provide additional information and clarify why only one 100% smoke purge fan unit is adequate.

ANSWER:

The smoke purge mode of operation is normally used, after a fire has been extinguished, for quick removal of smoke from the area. DCD Subsection 9.5.1 and Appendix 9A, Fire Hazard Analysis, provides further details of this operation. The normal area HVAC system is designed to automatically shutdown upon smoke presence; however, the purge fan operation is to be started manually, as deemed necessary. The smoke purge mode of operation has a special function for ventilation systems. It typically bypasses the smoke detection system to prevent tripping of the ventilation system. This allows continued operation of the air handling unit (AHU) fans to remove the smoke from the area. However, in this application the normal AHUs are not used for smoke purge. An independent smoke purge fan is started and closed dampers in the flow path from the air intake to the control room envelope are opened to allow smoke removal from the CRE.

The smoke purge portion of the MCR HVAC system outside the CRE and downstream of the safety related isolation damper at the wall of the CRE does not serve any safety-related function and has no safety design bases. Therefore, there is no requirement to provide redundancy for the smoke purge fan.

The smoke purge fan is sized to provide 10 air changes per hour, so that no more than 6 minutes are required to gain entry back into the MCR, after the fire has been extinguished. The normal area HVAC system operation may resume anytime after smoke-purge operation is completed.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-14

Provide additional details for the DCD section 9.4.1 calculations used to establish the equipment design data including: fan unit airflow, cooling coil, and heating coil capacities described in Table 9.4.1-1, including assumptions and margins. Provide sufficient calculations per SRP 9.4.1 Section IV.1.C to enable staff to support conclusions for the equipment design capacities listed above in Table 9.4.1-1.

ANSWER:

The MCR air handling unit (AHU) fan airflow rate (design) is determined by required cooling supply airflow rate. Required cooling supply airflow rate is calculated by following formula.

$$Q = q / (\rho\ Cp\ (ti - to)\ 60)$$

where,

Q : Supply airflow rate (CFM)
q : Heat load (BTU/h)
ρ : Density (0.075 lb/ft^3)
Cp : Specific heat (0.24 BTU/lb-F)
ti : Design room temperature (deg F)
to : Supply air temperature (deg F)

The design airflow rate of each room is as follows:

Area	Heat Load (BTU/h)	Required Cooling Supply Airflow Rate (CFM)	Design Airflow Rate (CFM)
MCR	131,000	9,330	11,000
Other	105,000	7,480	9,000
Total	-	-	20,000

Note 1: Heat load of each area is assumed based on the existing plant experience.
Note 2: Design airflow rate includes margin more than 15%.

The cooling coil capacity of MCR AHU is determined by sum of following heat loads.

Outdoor Air	63,000 BTU/h
Fan Motor	59,000 BTU/h
Room Internal Load	118,000 BTU/h
Moisture	83,000 BTU/h
Margin	18,000 BTU/h
Total	341,000BTU/h

Note: Each cooling load includes a margin of 15%.

The calculations used to establish the equipment design date of MCR emergency filtration unit is provided by the response to RAI No.49 Question No.06.04-4.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-15

US APWR DCD Tier 1 Figure 2.7.5.1-1 for the MCR HVAC system does not show the low and high efficiency filters in the air handling units that the US APWR DCD Tier 2 Section 9.4.1 Figure 9.4.1-1 shows for the same MCR HVAC system. Provide additional details on why the air handling unit filters are not shown in Figure 2.7.5.1-1.

ANSWER:

The low and high efficiency filters are not considered safety-significant aspect of this system, since the efficiencies of these filters are not credited in safety analysis. And the safety-significant aspect of this system is considered the cooling coil and heating coil, since the function of air handling unit is to maintain the room condition of MCR.

MHI believes that this approach meets the regulatory guidance described in Section 4.A, Appendix A of SRP 14.3 as follow, and no DCD Tier 1 change are needed.

"The applicant should put the top-level design features and performance characteristics that were the most significant to safety in the Tier 1 design descriptions. The level of detail in Tier 1 is governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform. The design descriptions include the figures associated with the systems."

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-16

The US APWR Table 9.4.1-1 Equipment Design Data does not list all of the components and corresponding data for the MCR Air Handling Units as shown in DCD Figure 9.4.1-1. For the MCR Air Handling Unit as listed in Table 9.4.1-1 there is no listing or data provided on the low efficiency prefilter and the high efficiency filter. These filters are discussed in the DCD section 9.4.1.2. Consistent with the guidance in RG 1.52 Rev. 3 position C.3.1 for ESF atmosphere cleanup systems, provide additional information on the low efficiency prefilters and high efficiency filters used in the MCR HVAC.

ANSWER:

DCD Subsection 9.4.1, Table 9.4.1-1 Equipment Design Data shall be revised to include low and high efficiency filters in the air handling units.

Impact on DCD

DCD Tier 2, Table 9.4.1-1 Equipment Design Data will be revised to add the low and high efficiency filter efficiency in DCD revision 2.

Main Control Room Air Handling Unit	
Low Efficiency Filter Efficiency	**25-35%**
High efficiency Filter Efficiency	**80-95%**
Main Control Room Emergency Filtration Unit	
High Efficiency Filter Efficiency	**80-95%**

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-17

SRP section III.3.C & D address control room habitability in the event of the release of airborne contamination. If an essential chiller has a large release of refrigerant vapor from the chiller refrigerant pressure boundary in its location of operation, are there potential pathways where the refrigerant can enter the MCR envelope? The new HCFC and HFC refrigerants are of particular safety concern. Provide additional information on refrigerant vapor as a source of airborne contamination which could impact control room habitability per SRP 9.4.1 Section III.3.C&D.

ANSWER:

There is no asphyxiation hazard associated with the control room atmosphere due to a potential release of refrigerants in areas adjacent to the control room, because of the remote location and structural barriers between the refrigerant and the control room air inlets. Essential chiller units are located on B1F in the Power Source Building. The non-essential chiller units are located on 3F in the Auxiliary Building. There is no refrigeration units used in the control room equipment.

Refer to response to the essentially identical question, RAI No.49 Question No.06.04-19.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-18

The second paragraph of the #6 "Technical Rational" Section II "Acceptance Criteria" of SRP 9.4.1 reads: "Regardless of the extent, if any, to which the CRAVS is expected to function to maintain suitable environmental conditions during a station blackout event, control room area equipment necessary for core cooling, maintenance of appropriate containment integrity, and other functions for withstanding or coping with the event, should be able to function under the expected environmental conditions of the event. The reviewer therefore verifies that the station blackout analysis appropriately addresses the potential failures of equipment/systems during the event (e.g., loss or degraded operability of the CRAVS, as appropriate), the expected environmental conditions of the event, the operability and reliability of equipment necessary to cope with the event under the expected environmental conditions, and the habitability of plant areas requiring operator access during the event and recovery period."

The DC applicant takes credit for one-hour restoration of power via the AAC. Per Regulatory Guide 1.155 (i.e. criteria #5 of Section 3.3.5) to take credit for the one-hour alignment of the AAC, the reliability of the AAC power system should meet or exceed 95 percent as determined in accordance with NSAC-108 (Ref. 11) or equivalent methodology. To date, the DC applicant has not demonstrated this reliability. Neither Section 2.6.5 "Alternate AC (AAC) Power Source" nor its related Table 2.6.5-1 of Tier 1 ITAAC testing requirements, contains the acceptance criteria that guarantee this AAC reliability.

Without a guaranteed AAC reliability of ≥ 95%, the coping duration will become the basis for the environmental qualification of MCR electrical controls and instrumentation during the SBO event. To what worst case ambient conditions (i.e. temperature and humidity) are the instrumentation and controls within the MCRE qualified. What is the qualified life of the CRE instrumentation and controls for those conditions?

The maximum potential coping duration is established at 16 hours (last full paragraph reference page 1.155-2 of RG1.155). DCD Section 8.4.1.4 details an 8 hour coping duration.

The staff requests that the DC applicant provide further information as to how this 8 hour coping duration was established since the actual coping duration is site specific.

In addition, from the review of Table 8.3.1-6 "Electrical Load Distribution –AAC GTG Loading (SBO Condition)", it is not clear that the necessary components to maintain the MCRE within the "Abnormal Condition" the design temperature limits of Table 9.4-1 (Sheet 1 of 3) are powered by the AAC. The staff requests that the DC applicant provide additional information that confirms that all necessary controls, instrumentation and components of the MCR HVAC Air Handling units are powered from the AAC.

ANSWER:

When SBO occurs, AAC can connect to Class 1E bus within one hour. Therefore MCR HVAC system can be operated within one hour. CRE instrumentation and controls can be functioned without HVAC within one hour during SBO.

Eight hour coping duration is determined in accordance with table 2 of RG1.155. "Offsite Power Design Characteristic Group", "Emergency AC Power Configuration Group" and "Unit "Average" EDG Reliability" have to be selected to determine the duration. The reliability of AAC does not have an affect on the SBO duration capability.

Offsite Power Design Characteristic Group:

"Offsite Power Design Characteristic Group" is including site-specific factor. Therefore, P3 is selected conservatively.

Emergency AC Power Configuration Group:

"Emergency AC Power Configuration Group" is selected in accordance with table 3 of RG1.155. US-APWR has four train systems and

Unit "Average" EDG Reliability:

Reliability of Class 1E Gas Turbine Generator is evaluated in Technical Report MUAP-07024 and discussed in "Responses to RAI No.5 Question No.08.03.01-2 and No.08.03.01-3". The assessed reliability is higher than 0.99. However, in this evaluation of coping duration, "0.95" is selected conservatively.

Based on above, SBO duration capability was determined "8 hours".

Table2 Acceptable Station Blackout Duration Capability

Offsite Power Design Characteristic Group	Emergency AC Power Configuration Group						
	A		B		C		D
	Unit "Average" EDG Reliability						
	0.975	0.95	0.975	0.95	0.975	0.95	0.975
P1	2	2	4	4	4	4	4
P2	4	4	4	4	4	8	4
P3	4	8	4	8	8	16	8

EAC Power Configuration Group	Number of EAC Power Sources	Number of EAC Power Sources Required to Operate AC-Powered Decay Heat Removal System
A	3[d]	1
	4	1
B	4	2
	5	2
C	2	1
	3	1
D	2	1
	3	2
	4	3
	5	3

Electrical Load Distribution – AAC GTG Loading (SBO Condition):

Table 8.3.1-6 shows large capacity loads only. Small capacity loads such as MCR HVAC Air Handling units, are included "Motor Control Center" which is bottom load of Class 1E Bus.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-19

An excerpt from SRP 9.4.1 Section III "Review Procedures" 2.A reads: "Essential portions of the CRAVS are correctly identified and are isolable from nonessential portions of the system. The P&IDs are reviewed to verify that they clearly indicate the physical divisions between such portions and indicate design classification changes. System drawings are also reviewed to verify that they show the means for accomplishing isolation and the system description is reviewed to identify minimum performance requirements for the isolation dampers. ..."

An excerpt from SRP 9.4.1 Section III "Review Procedures" 2.B reads: "... SAR component and system descriptions of mechanical and performance characteristics are reviewed to verify that the classifications are included and that the P&IDs indicate any points of change in design classification."

The relevant DCD P&IDs (e.g. Figures 9.4.1-1, 6.4-2) fail to differentiate the essential portions of the CRAVS from nonessential portions of the system. The system description of DCD Section 9.4.1 does not identify minimum performance requirements for the isolation dampers. The staff requests that the DC applicant amend the DCD to eliminate these deficiencies.

ANSWER:

The relevant DCD P&IDs (Figure 9.4.1-1, Figures 6.4-2 through 6.4-4) will be revised to include the classifications of the system.

Impact on DCD

The relevant DCD P&IDs (Figure 9.4.1-1, Figures 6.4-2 through 6.4-4) will be revised to include the classifications of the system.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-20

DCD Figure 6.4-2 "MCR HVAC System (Normal Operation Mode)" and Figure 9.4.1-1 "MCR HVAC System Flow Diagram" both display the areas of the MCRE. Both figures do not label the area below the "Corridor" area. Figure 6.4-1 "Main Control Room Envelope" displays this unlabeled area on the top middle center of the Figure, as well. The staff requests that the DC applicant provide additional information about the intended function of this unlabeled area and how this unlabeled area satisfies the criteria for inclusion in the MCRE per SRP 6.4 section III.1?

ANSWER:

Figures 6.4-1 through 6.4-4 and Figure 9.4.1-1 of DCD revision 1 were revised to label all area of CRE.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-21

An excerpt from SRP 9.4.1 Section III "Review Procedures" 1 reads: " ... The system performance requirements section is reviewed to determine that it describes allowable component operational degradation (e.g., loss of cooling function, damper leakage) and describes the procedures that will be followed to detect and correct these conditions...."

While DCD Section 9.4.1.4 "Testing and Inspection Requirements" provides minimal information about the procedures that used to detect and correct these conditions it provides no information about allowable component degradation. The staff requests that the DC applicant provide additional information for both these system performance attributes.

ANSWER:

To reduce or eliminate component failures, routine testing of components of the MCR HVAC system is conducted in accordance with routine power plant requirements, some or all of which are recommended, endorsed or mandated by recognized power plant engineering organizations (i.e. EPRI). The routine requirements shall consist of preventative maintenance (PM) programs that include regular surveillance and testing, and replacement of components prior to them reaching a "degraded" condition corresponding to a state of inoperability. Although the PM programs cannot predict or foresee sudden failures, it strives to track and trend component reliability and PM performance frequencies are updated based on trended data on component failure frequency.

A Table or list of probable "degraded" component conditions (i.e. cooling coil failure, supply fan failure, damper sealing deficiencies) that result in loss of cooling function or damper leakage does not currently exist. It is thought that this information is probably best denoted within the context of a Table or list associated with an FMEA study.

The FMEA for MCR HVAC system will be added in DCD revision 2. Refer to Question No.09.04.01-8.

Impact on DCD

DCD Subsection 9.4.1.4 of DCD revision 1 will be revised to provide immediate clarity and understanding in DCD revision 2.

9.4.1.4 Testing and Inspection Requirements

The MCR HVAC system is provided with adequate instrumentation, temperature, flows and differential pressure indicating devices to facilitate testing and verification of equipment **function,** heat transfer capability and flow blockage.

The MCR HVAC system is designed to permit periodic inspection and testing of major components, such as fans, motors, dampers, coils, filters and ducts to verify their integrity, operability and capability. The MCR HVAC system equipment and components are provided with proper access for initial and periodic inspection and maintenance activities.

Preoperational testing of the MCR HVAC system is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with applicable programs and specifications. ~~The air handling unit airflows are balanced to provide proper air mixing and uniform temperature throughout the CRE.~~

Routine testing of the MCR HVAC system is conducted in accordance with normal power plant requirements, facilitated by testing programs and written procedures. This testing demonstrates system and component operability and integrity.

Periodic surveillance testing of the MCR HVAC safety-related systems is carried out in accordance with IEEE-338. This standard invokes periodic testing consisting of functional tests and checks, calibration verification and time response measurements as required, to ensure system function and availability.

During normal operation equipment rotation is performed to minimize and equalize wear on redundant equipment.

~~During normal operation, the standby air handling units are periodically tested for operability or, alternatively, placed in service in place of the train which had been operating.~~

~~During normal operation, the filtration units are periodically tested for operability.~~

~~The MCR HVAC system equipment and components are provided with proper access for initial and periodic inspections and maintenance during normal operation.~~

Air handling units are factory tested in accordance with Air Movement and Control Association (AMCA) standards. Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers **(ASHRAE)** standards. Cooling coils are hydrostatically tested in accordance with ASME Section III (Ref. 9.4.8-7) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute **(ARI)** standards.

~~Air distribution~~ Ductwork is leak-tested in accordance with the Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA) and American Society of Mechanical Engineers, ASME N510 (Ref. 9.4.8-8).

Emergency filtration units are factory tested for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.52 (Ref. 9.4.8-3), ASME N510 and ASME AG-1 (Ref. 9.4.8-2). The HEPA filters are checked periodically ~~and alarmed in the MCR on high differential pressure.~~**, and c**harcoal adsorber samples are tested for efficiency in an independent laboratory in accordance with RG 1.52 and ASTM D 3803 (Ref. 9.4.8-9).

The above testing and inspection procedures shall identify deficient systems and components on an ongoing basis, and plant maintenance programs shall correct deficiencies as found.

Inservice test program requirements, including inleakage testing, are described in Chapter 16, “Technical Specifications”.

The isolation dampers will be inspected periodically and the damper seats are replaced as required.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-22

Regulatory Guide 1.29 "Seismic Design Classification" Section C,3 reads: "At the interface between Seismic Category I and non-Seismic Category I SSCs, the Seismic Category I dynamic analysis requirements should be extended to either the first anchor point in the non-seismic system or a sufficient distance into the non-Seismic Category I system so that the Seismic Category I analysis remains valid." (Also reference Acceptance Criteria 1 of SRP 9.4.1)

An excerpt from DCD Section 9.1.4.3 "Safety Evaluation reads" ... All system equipment and components, with the exception of the toilet/kitchen exhaust and smoke purge fans and the in-duct heater electric heating coils, are classified as equipment class 3, seismic Category I."

Table 3.2-2 lists the toilet/kitchen exhaust and smoke purge fans as "NS" (i.e. DCD Section 3.2.1.1.3 Non Seismic). This Table does not differentiate the ductwork downstream (i.e. outside the MCRE) of the outermost safety-related seismic I isolation dampers associated with the toilet/kitchen exhaust and smoke purge fans. Is this ductwork seismic I as well? In addition, DCD Section 9.4.1 and Figures 9.4.1-1, 6.4-2, 6.4-3 & 6.4-4, fail to identify the destination of the exhaust flow from the toilet/kitchen exhaust and smoke purge fans.

Is any/or all of this ductwork classified as Seismic Category II in accordance with DCD Section 3.2.1.1.2?

The staff request additional information about the ductwork downstream (i.e. outside the MCRE) from the outermost safety-related seismic I isolation dampers associated with the toilet/kitchen exhaust and smoke purge fans to the final destination of these two exhaust flows. In particular, the staff request additional information of how the design of this ductwork satisfies the Regulatory Positions C.1, C.2 and C.3 of Regulatory Guide 1.29.

The same Figures listed above identify back draft dampers in the discharge ductwork of the two toilet/kitchen exhaust fans but not in the discharge ductwork from the smoke purge fans. Since DCD section 9.4.1 fails to identify the existence of and the purpose of back draft dampers in the MCR HVAC system, it is not clear whether a back draft damper should be installed in the discharge ductwork from the smoke purge fans to prevent to back flow of contaminants into the MCRE.

The staff requests additional information with respect to: (1) the ultimate destination of the discharge flow from the toilet/kitchen exhaust and smoke purge fans; (2) the purpose(s) of the back draft dampers; and (3) the reason for not addressing these dampers in Table 3.2-2. The staff requests that the DC applicant amend (as applicable) the DCD to reflect the additional information provided.

ANSWER:

Figure 9.4-1, Figure 6.4-2, 6.4-3 and 6.4-4 are revised to indicate the classification for the MCR HVAC system, including MCR toilet/kitchen exhaust and MCR smoke purge fan. Refer to RAI Question No.09.04.01-19.

In particular, please note that even though the MCR toilet/kitchen exhaust fan, smoke purge fan and ductwork downstream of isolation dampers are as identified as Equipment Class 5, if there are other safety-related equipments located below these non-safety equipments, it is possible that these fans should be Seismic Category II, for possible interaction with safety related equipment and pipe routing around the area.

Figure 9.4-1 identifies back draft dampers located in the discharge ductwork of the toilet/kitchen exhaust line. The following is the response to each question:

(1) The ultimate discharge destination of the discharge flow from the toilet/kitchen exhaust and smoke purge fans is to the outside air/environment.

(2) One of two MCR kitchen/toilet exhaust fans is operated in normal operating mode, so that back draft dampers are provided to prevent the back flow of suspended kitchen/toilet exhaust fan from the other operated kitchen/toilet exhaust fan.

(3) These back draft dampers will be indicated in Table 3.2-2 of DCD revision 2.

Impact on DCD

Figure 9.4.1-1, Figures 6.4-2 through 6.4-4 will be revised to indicate the classifications of the system. Refer to RAI Question No.09.04.01-19.

The purpose of back draft damper will be reflected in appropriate section of DCD revision 2.

Table 3.2-2 will be revised to address these back draft dampers.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-23

For the MCR Emergency Filtration Unit, DCD Table 6.4-1 has a specification listed for the HEPA particulate removal efficiency of 99%. DCD Table 9.4.1-1 "Equipment Design Data" list a HEPA Filter Efficiency of "99.97%, 0.30 micron particles". The staff requests that the DC applicant provide additional information that explains the discrepancy and any potential impact on Main Control Room Dose Calculations.

ANSWER:

The differences noted in the stated HEPA filter efficiencies for the MCR emergency filtration unit are based on the context of the described rating, i.e., design basis values versus equipment design specification values. A filter design efficiency rating of 99.97% (design specification) is used to ensure that the minimum filter efficiency of 99% (design basis) can be credited in the safety analysis.

Design Basis
Table 6.4-1, Main Control Room Emergency Filtration System – Equipment Specifications, presents design bases and component specifications for the MCR emergency filtration system. The design basis is the assumed filter efficiency from the accident analysis. Table 15.6.5-5, US-APWR Input Parameters Used in the Main Control Room Consequence Analysis for the LOCA, assumes a 99% HEPA filter efficiency for particulates for the MCR emergency filtration system. This filter efficiency is credited by the in-place test states in Section 6.3 of RG 1.52 Rev.3.

Design Specification
Table 9.4.1-1, Equipment Design Data, identifies the design rating of the MCR HVAC system. Consistent with RG 1.52, section 4.4, HEPA filters used in ESF atmosphere cleanup systems should be designed, constructed, and tested in accordance with Section FC of ASME AG-1. Section FC of ASME AG-1 defines the HEPA filter as "The filter shall exhibit a minimum efficiency of 99.97% when tested with an aerosol of essentially monodispersed 0.3 micrometer diameter test aerosol particles."

Impact on DCD

Table 9.4.1-1 will be revised to include the HEPA filter efficiency of 99% (design basis) in DCD revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-24

DCD Section 9.4.1.4 "Testing and Inspection Requirements" (second paragraph) reads: "Preoperational testing of the MCR HVAC system is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with plans and specifications. The air handling units airflows are balanced to provided proper air mixing and uniform temperature throughout the MCR envelope."

The DCD does not contain the design basis flow rates to the particular areas of the control room envelope that: (1) ensures positive pressures (i.e. ≥ 0.125" w.g. relative to all adjacent areas outside the MCRE); and (2) ensures proper air mixing and (3) ensures uniform temperatures throughout the MCR envelope.

An example that further illustrates this deficiency is the Normal Operation Mode of the MCR HVAC System. The fourth bulleted item of DCD Section 9.4.1.2.1 reads "During the normal operation mode, the selected air handling units run on a fixed outside airflow sufficient to provide makeup to maintain MCR envelope at a slightly positive pressure with regard to the adjacent area."

The staff requests that the DC applicant provide a design based value for this "slightly positive pressure" during the Normal Operation Mode that precludes un-monitored radioactive contamination (i.e. by bypassing the fresh air intakes) from infiltrating the Control Room Envelope.

ANSWER:

The DCD contains design flow rates in table form only for normal mode operation (See DCD Table 9.4.1-1). Refer to RAI Question No.09.04.01-25 which requests inclusion of MCR HVAC flow rates for other modes of operation into their respective section descriptions.

Regardless of the mode of operation, airflow from the MCR air handling units (AHUs) is directed into the whole of the CRE (i.e. there is no particular area of the CRE that requires a certain amount of airflow that would affect pressurization uniquely; i.e. the CRE is one contiguous volume unaffected by internal partitions). Positive pressure of the CRE (during emergency pressurization mode) will be ensured by excess air that exfiltrates from the CRE. This exfiltrated air is replenished at the outside air intakes via make-up air. The extent of pressurization is a function of exfiltration airflow and sealing characteristics of penetrations and doors of the CRE. The system shall provide for maintaining the design minimum positive pressure (0.125 inch w.g.)

corresponding to a minimum of design (excess) exfiltration air. MHI to demonstrate or document that exfiltration air shall provide for this minimum pressurization level of the CRE.

Regarding proper air mixing and uniform temperature controls: the MCR HVAC system is designed such that each space within the CRE will require a certain amount of airflow to satisfy its design heat load, and that ductwork to each space will be sized accordingly and configured to ensure satisfactory mixing and temperature control. Therefore, balancing of system airflows is done primarily to ensure each space receives its design airflow, with mixing and temperature control occurring by default. Once balancing is done, different modes of operation do not affect the settings.

Impact on DCD

Refer to RAI Question No.09.04.01-25 for revision of the fourth bullet item of DCD Subsection 9.4.1.2.1 (regarding resolution of "slightly positive pressure" during normal mode operation) and inclusion of flow rates for various modes of operation.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.63 REVISION 0**
SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
APPLICATION SECTION:	**09.04.01 MAIN CONTROL ROOM HVAC SYSTEM**
DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-25

DCD Table 9.4.1-1 "Equipment Design Data" indicates that the design supply air flow rates to the CRE from two MCR Air Handling Units equals 20,000 cfm. This same Table indicates that operation of one of the MCR Toilette/Kitchen Exhaust fans will remove1800cfm from the CRE. Beyond this information, the COL applicant has no supply and exhaust flow information available in the DCD to flow balance the HVAC system to maintain normal area temperatures and a slightly positive pressure within the CRE.

DCD Section 9.4.1.4 "Testing and Inspection Requirements" (second paragraph) reads: "Preoperational testing of the MCR HVAC system is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with plans and specifications. The air handling units airflows are balanced to provided proper air mixing and uniform temperature throughout the MCR envelope."

There is nothing within DCD Section 14.2.12.1.101 "MCR HVAC System Preoperational Test" that reflects the above passage during Preoperational Testing" (i.e. provided proper air mixing and uniform temperature throughout the MCR envelope). DCD Section 9.4.1.2.2.1 "Pressurization Mode" fails to list a design based pressurization value (i.e. ≥ 0.125" w.g.) for the Main Control Room Envelope. The staff requests that the DC applicant amend DCD Sections 9.4.1.2.2.1 and 14.2.12.1.101 to address these deficiencies.

The staff requests that the DC applicant amend DCD Section 9.4.1 to include the design basis flow rates for all four modes of system operation to the particular areas of the control room envelope.

ANSWER:

Typically, under the normal mode of operation of the MCR HVAC System, the CRE does not need to be maintained at a positive pressure. The pressure in the CRE is not an issue of concern during normal mode of operation. Hence, the fourth bullet in Subsection 9.4.1.2.1 will be revised to read as follows:

"During normal operation mode, the selected air handling units run on a fixed amount of outside airflow sufficient to maintain a normal environment in the CRE. The pressure in the CRE is not an issue of concern during normal mode of operation."

In Subsection 9.4.1.2.2.1, insert the following after the bulleted items as the last paragraph, "In the emergency pressurization mode of operation, the CRE is maintained at a positive pressure 0.125 inches w.g. as a minimum relative to external areas adjacent to the CRE boundary."

DCD will be revised to include the design basis flow rates for all four modes of system operation.

In Subsection 9.4.1.2.1, "Normal Operation Mode", insert the following sentence after the last bulleted item as a new paragraph:

"In the normal mode of operation, the MCR HVAC system design airflow rate is 20,000 cfm."

In Subsection 9.4.1.2.2.1, "Pressurization Mode" insert the following sentence after the last bulleted item as a new paragraph:

"In the emergency pressurization mode of operation, the MCR HVAC system design airflow rate is 20,000 cfm and the make-up design airflow rate is less than 1,200 cfm."

In Subsection 9.4.1.2.2.2, "Isolation Mode", insert the following sentence after the last bulleted item as a new paragraph:

"In the emergency isolation mode of operation, the MCR HVAC system design airflow rate is 20,000 cfm."

In Subsection 9.4.1.2.3, "Smoke Purge Operation Mode", insert the following sentence after the last bulleted item as a new paragraph:

"In the smoke purge mode of operation, the MCR HVAC system design airflow rate is 20,000 cfm."

Impact on DCD

Insert the above-mentioned text in the respective DCD section as stated.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-26

The first paragraph of DCD Section 9.4.1.2.3 "Smoke Purge Operation mode" reads: "If the smoke detectors located in the supply and return air ducts and the area smoke detectors in the MCR envelope detect the presence of smoke, the air handling units automatically shut down and an alarm is annunciated in the MCR."

The fourth paragraph on page 9.4-7 of DCD Section 9.4.1.3 "Safety Evaluation" reads: "In the event of fire and smoke presence in the MCR envelope, smoke detectors will alarm in the MCR. If required, the operator can initiate the smoke purge mode when the emergency mode is not in effect."

There are no area smoke detectors displayed within the CRE in any of the Figures related to DCD Sections 9.4.1 and 6.4 "Habitability Systems". There are no words about MCRE area smoke detectors contained in Section 6.4. Similarly, the staff could not fine in DCD Chapter 7 "Instrumentation and Controls" any information about the MCRE area smoke detectors and MCR alarms.

The staff requests that the DC applicant include the details of these MCRE area smoke detectors and MCR alarms in the relevant subsections of DCD Chapter 7 and Sections 9.4.1 and 6.4. In addition, the staff requests that the DC applicant add a figure displaying the "Smoke Purge Operation mode" to Section 6.4.

ANSWER:

DCD Subsection 9.5.1, Fire Protection Program, and Appendix 9A, Fire Hazard Analysis, provides a detailed discussion on the fire protection features provided for the control room. DCD Subsection 9.5.1.2.6 specifically covers Fire Detection and Fire Alarm Systems.

Impact on DCD

DCD Subsection 9.4.1.5, Instrumentation Requirement, will be revised to add the following new paragraph at the end of the section:

"The requirements for controls and instrumentation associated with fire protection for the control room are provided in Subsection 9.5.1, and Appendix 9A, Subsection 9A.3.44 Main Control Room."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.04.01-27

DCD Section 9.4.1.4 "Testing and Inspection Requirements" indicates that the standby air handling units are periodically tested for operability. Surveillance Requirement SR 3.7.10.5 of Technical Specification 3.7.10 "Main Control Room HVAC System (MCRVS)" reads "Verify two MCRATCS trains have the capacity to remove the assumed heat load".

The "assumed heat load" of SR 3.7.10.5 will be based on the extremes in local weather conditions at the site. There is no "Combined License Information" item in DCD Sections 9.4.7 or 16.2 that highlights the need for each COL applicant to develop an assumed heat load calculation that will provide the basis for the surveillance requirement acceptance criteria.

The staff requests that the DC applicant add a COL item to both DCD Sections 9.4.7 or 16.2 that captures this need.

In addition, the way the current SR reads is open to interpretation. Succinctly, the SR needs to demonstrate that each of the four AHU trains remove ≥ 50% of the "assumed heat load" on 24 month basis.

The staff requests that the DC applicant revise the wording of SR 3.7.10.5 to remove the ambiguity.

ANSWER:

The capacity to remove the design heat load of the MCR HVAC system is not identified as a COL item. The site-related parameter for DCD of US-APWR bound an estimated 75% to 80% of the United States landmass, including all sites under current consideration. Therefore, the coil capacity of MCR HVAC system for the specific site will likely be smaller.

The description of SR 3.7.10.5 "assumed heat load calculation" is meaningless and doesn't have any application during acceptance testing. Acceptance testing can only be verified by running the system (with the required minimum number of AHUs operating) to see if the system maintains the design set point temperatures.

Surveillance Requirement SR 3.7.10.5 of the Tech Specs should be recognized as implicit in its requirement to test the system under the most extreme ambient conditions possible; however it will be revised to be less confusing.

Impact on DCD

SR 3.7.10.5 of Technical Specification, Chapter 16, will be revised as follows;

SR 3.7.10.5	Verify two MCRATCS trains have the capacity to remove the ~~assumed~~ **design** heat load.	24 months

Impact on COLA

There is impact on COLA to incorporate the DCD change.

Impact on PRA

There is no impact on the PRA.

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10/03/2008

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QUESTION NO. : 09.04.01-28

The third paragraph on page 9.4-7 of DCD Section 9.4.1.3 "Safety Evaluation" reads: "Redundant safety-related Class 1E radiation monitors are located in the outside air intake duct to automatically switch the MCR HVAC system from the normal operation mode to the emergency pressurization mode upon detection of a radiological level higher than a predetermined value."

DCD Section 7.3.1.5.7 "MCR Isolation" reads "High MCR outside air intake radiation: There are six MCR outside air intake radiation monitors interfaced separately to RPS trains A and D (two gas monitors, two iodine monitors, and two particulate monitors)."

DCD Figures 9.4.1-1, 6.4-2, 6.4-3 and 6.4-4 display two radiation monitors in a location that appears to be sensing radiation from both outside-fresh-air intake lines simultaneously. Does the line that the radiation monitors are connected to in these Figures, represent a crossconnect between the two ESF filter trains? If this is not the case, then the following passage from the sixth paragraph of DCD Section 6.4.2 contains an error. It reads: "For automatic initiation in emergency pressurization mode, a portion of the return air flow is directed into the emergency filtration units. Outside air is drawn in through **either** of the two tornado-generated missile protection grids and the tornado depressurization protection dampers, and is directed to both 100% capacity MCR emergency filtration units and all 50% capacity MCR air handling units."

Should it be changed to read: "For automatic initiation in emergency pressurization mode, a portion of the return air flow is directed into the emergency filtration units. Outside air is drawn in through **both** of the two tornado-generated missile protection grids and the tornado depressurization protection dampers, and is directed to both 100% capacity MCR emergency filtration units and all 50% capacity MCR air handling units."?

The staff requests that the DC applicant provide additional information about this instrumentation configuration with respect to: (1) the number of monitors shown (i.e. two) on the listed Figures versus the six monitors described in DCD Section 7.3.1.5.7. (2) the implications of safety related divisional separation for these SR monitors since both shown monitors appear to be tied to both divisional trains of the ESF filter trains. (3) the physical location (i.e. distance from) of the radiation monitors with respect to the missile shields (i.e. air inlet of Figure 6.4-5); to the ESF filter trains and to the redundant safety related leak-tight dampers VRS-MOD-101A, VRS-MOD-102A, VRS-MOD-101B and VRS-MOD-102B.

ANSWER:

The following responses are presented in the same order as were in the original RAI:

(1) The number of monitors shown (i.e. two) on the listed figures (Schematic Drawings) is an approximation of what is correctly (i.e. six) described in detail in DCD Subsection 7.3.1.5.7, and Figure 7.2-2, Sheet 12. It is not the intent of the HVAC system figures to include those entire details; as they are part of the instrumentation systems design and, therefore, fully shown/ explained in the DCD Chapter (7.3, e.g.) for instrumentation. However, the exact number of monitors will be added to the listed figures to avoid any confusion.

(2) Due to the above approach, the result is the appearance as if the SR monitors are tied to both divisional trains of the ESF filter trains. A NOTE will be added to each of the listed Figures, to clarify this confusion.

(3) The MCR HVAC Gas Monitor Rooms are physically located in the Reactor Building at elevation 50'-2" (3rd Floor.) on the East side of the Plant, and the opposite West sides respectively (See Figure 1.2-20, Reactor Building at Elevation 50'-2", and Figure 6.4-5). This allows these radiation monitors adequate remoteness with respect to the missile shields; to the ESF filter trains and to the redundant safety related leak-tight dampers. A switching valve allows remote selection (See last bullet, DCD Section 9.4.1.2.2.1) of the air-path so that only radiation-free, particulate-free, and non-toxic fresh outside air is allowed to be drawn into the HVAC system for supplying to the MCR.

Impact on DCD

DCD Figures 6.4-2, 6.4-3, 6.4-4 (DCD Section 6.4), and 9.4.1-1 (DCD Subsection 9.4.1) will be revised to add an exact number of monitors and a new Note as follows:

Note: The air suction line to radiation monitor is changed by switching valve.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

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Docket No. 52-021

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QUESTION NO. : 09.04.01-29

An excerpt from DCD Section 6.4 reads "Actual MCR floor elevation is 26 ft. - 11 in. to accommodate the cable spreading area under the floor. The CRE is served by the MCR HVAC system, which maintains the habitability of the MCR."

DCD Table 9.5-2 "US-APWR Fire Protection Program Conformance with NFPA 804 (Sheet 41 of 56)" indicates conformance with the sixth Standard Requirement of which reads: "Area automatic fire suppression shall be provided for under floor and ceiling spaces if used for cable runs unless all cable is run in 4 in. (101.6 mm) or smaller steel conduit or cables are in fully enclosed raceways internally protected by automatic fire suppression."

The staff found insufficient evidence to conclude that the DC applicant considered fire suppression in the design of the CRE Habitability System and the Main Control Room HVAC System. The staff requests that the DC applicant provide additional ITAAC to ensure all the applicable requirements can be verified.

ANSWER:

Fire protection for the CRE is covered in DCD Subsection 9.5.1, Fire Protection Program, and Appendix 9A, Fire Hazard Analysis. DCD Subsection 9.5.1.2.5 addresses automatic extinguishing systems, which includes the Automatic Gaseous Suppression System that is employed for the raised-floor area in the MCR and an automatic water mist fire suppression system. These fire protection systems for CRE have been evaluated in DCD Subsection 9.5.1.2.5 and in Appendix 9A, section 9A.3.44.

The ITAAC of fire protection system is already provided in Subsection 2.7.6.9 of DCD Tier 1.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-30

The last paragraph of DCD Section 9.4.1.2 "System Description" reads: "All duct penetrations in fire walls are protected by fire dampers to prevent the spread of fire from an affected area to the adjacent redundant component areas." GDC 3 (i.e. Fire Protection)

DCD Section 9.5.1.2.7 reads "Ventilation system fire dampers close automatically against full airflow, if required, on high temperature to limit the spread of fire and combustion products. Fire dampers serving certain safety-related, smoke-sensitive areas are also closed in response to an initiation signal from the fire detection system. In selected areas, the fire alarm system will provide interface with the HVAC systems such as to shut down HVAC operation upon a fire alarm signal. Where continued HVAC system operation is deemed necessary for radiological control, the HVAC system incorporates design features to allow operation under fire conditions."

The staff requests that the DC applicant provide additional information about what generic HVAC system attributes contained in the passage from DCD Section 9.5.1.2.7 are applicable to the operation of the MCR HVAC system.

ANSWER:

The MCR HVAC system uses a curtain type fire damper at all ventilation openings to the CRE that will close automatically on high temperature, released through a fusible link. This is adequate for the following reasons:

1. The MCR is occupied 24 hour continuous by personnel trained in fire protection. Thus minimizing the chance of a small fire from growing to an uncontrolled fire.
2. The gaseous suppression system for the raised-floor area is isolated from the MCR and unaffected by the continued operation of the MCR HVAC system.
3. The fire dampers cannot be automatically closed by the smoke detection system because this would defeat the design feature of the MCR HVAC system to automatically switch to the emergency isolation mode of operation.
4. A typical automatic release through a smoke detection system uses an Electric Thermal Link (ETL). The fusible link is electrically melted to allow the damper to close but cannot be reopened automatically. It has to be manually reopened, which is time consuming and not easy or convenient. This will result in a loss of ventilation for a significant time.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

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QUESTION NO. : 09.04.01-31

Acceptance Criteria 5 of SR 9.4.1 reads: "Control of Releases of Radioactive Material to the Environment. Information that addresses the requirements of GDC 60 regarding the suitable control of the release of gaseous radioactive effluents to the environment will be considered acceptable if the guidance of RGs 1.52 and 1.140 as related to design, inspection, testing, and maintenance criteria for post-accident and normal atmosphere cleanup systems, ventilation exhaust systems, air filtration, and adsorption units of light-water-cooled nuclear power plants are appropriately addressed. For RG 1.52 rev 2, the applicable regulatory position is C.2. For RG 1.52 rev 3, the applicable regulatory position is C.3. ..."

The staff could find no reference to the replacement of filters used during plant/system construction in DCD Section 9.4.1. Regulatory Guide 1.52 "Design, Inspection, And Testing Criteria For Air Filtration And Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems In Light-Water-Cooled Nuclear Power Plants" position C 5.2 reads "The cleanup components (i.e., HEPA filters, prefilters, and adsorbers) that are used during construction of the ventilation systems should be replaced before the system is declared operable."

The staff requests that the DC applicant amend DCD Section 9.4.1 to reflect this requirement.

ANSWER:

Partial conformance to RG 1.52 is explained in the seventh paragraph of DCD Subsection 9.4.1.4. However, the replacement of HEPA filters prior to pre-operational testing used during plant/system construction is not addressed in DCD Subsection 9.4.1.4. DCD Subsection 9.4.1.4 will be amended with adequate modification.

Impact on DCD

DCD Subsection 9.4.1.4 will be revised to insert the following sentence:

Prior to preoperational testing, all HEPA filters, prefilters and absorber material that are used during plant/system construction are to be replaced. This is performed in accordance with the guidance of RG 1.52 (Ref.9.4.8-3).

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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SRP SECTION:	**09.04.01 – CONTROL ROOM AREA VENTILATION SYSTEM**
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DATE OF RAI ISSUE:	**09/04/2008**

QUESTION NO. : 09.04.01-32

Acceptance Criteria 5 invokes regulatory position C.3 "System Design Criteria" of Regulatory Guide 1.52. Section 3.11 reads: "Outdoor air intake openings should be equipped with louvers, grills, screens, or similar protective devices to minimize the effects of high winds, rain, snow, ice, trash, and other contaminants on the operation of the system. The outdoor air intake openings should be located to minimize the effects of possible onsite plant contaminants, such as the diesel generator exhaust. If the atmosphere surrounding the plant could contain significant environmental contaminants, such as dusts and residues from smoke cleanup systems from adjacent coal-burning power plants or industry, or is a salty environment near an ocean, the design of the system should consider these contaminants and prevent them from affecting the operation of any ESF atmosphere cleanup system."

The staff requests that the DC applicant provide additional information about the location of the ESF Filter train fresh air intakes with respect to **known** on-site fresh air contaminants such as diesel fumes, chemical storage tanks etc. Since the siting of power plant could impact the positioning of the fresh air intakes due local industry (e.g. coal-burning power plants) the wording of COL 9.4.1 appears to be too limiting.

ANSWER:

The CRE air inlets are located on the east and west wall at elevation 50'-2" in the reactor building (R/B). For reference, see Figure 6.4-5 and 6.4-6 of DCD Section 6.4. There are no potential sources of stored hazardous materials, which can enter the CRE through the two air inlet locations. As recommended by RG 1.78, the storage areas of hazardous chemicals (that include ammonia or organic amines, and hydrazine) are sited at a distance greater than 330 ft. from the air inlets of the CRE (Refer to DCD Subsection 6.4.4.2.).

The closest potential source of fresh air contamination is the exhaust from the Emergency Gas Turbine Generators (GTGs) in the power source buildings (PS/Bs) located adjacent to the R/B along the east and west walls. There are three GTGs in each PS/B. The roofs of the PS/Bs are at elevation 39'-6". For each GTG, there are two exhaust sources. One is the GTG enclosure ventilation exhaust and the other is the GTG exhaust. There are also two air inlets for each GTG. One is the GTG room's ventilation supply air inlet and the other is a dedicated combustion air supply inlet for the GTG. The closest GTG room ventilation fan exhaust vent is approximately 26 ft. away horizontally from the CRE air inlet. This is well above the minimum of 10 ft. required according to the International Mechanical Code (Section 401.5.1).

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.